

# **SAFE TIRE WITH A SUPPORTING APPARATUS**

## **BACKGROUND OF THE INVENTION**

### **1.FIELD OF THE INVENTION**

This present invention relates to a safe tire, particularly with a supporting apparatus for providing a backup support when pressure is lost in the safe tire and it runs flat.

### **2.DESCRPTION OF THE PRIOR ART**

Tires today are highly reliable and durable — but they're not invulnerable, they can be damaged by lack of maintenance or accidents, such as running over nails or into holes. Therefore, that means that tire failures—flat tires—sometimes happen. Many cars have small “temporary use only” spare tires. These are designed for limited use, and most importantly, not every driver has the ability to exchange the flat tires by themselves. Hence, a “safe tire” with a backup support mechanism is under development. The car, equipped with the safe tire can be driven on for a safe distance even if the safe tire is flat and the pressure is at zero.

First, a cross-sectional view of a conventional safe tire system is shown in FIG.1. The safe tire system is composed of a tire, a wheel, and a supporting ring 113. The tire is a symmetrical structure and can be divided into a tread 101, a shoulder 102, a sidewall 103, and a bead 104. The tread 101, running the

circumference around the tire, is the section that makes contact with the road's surface. The shoulder 102 refers to the section starting from the tread 101 edge to the upper part of the sidewall 103. The sidewall 103 refers to the side section of tire, providing driving comfort through bending and stretching. The bead 104, the bottom part of the tire, is arranged to hook the tire onto a rim 111 of the wheel with a wire bead 105 (composed of steel wire and core rubber).

The wheel is designed as a single unit in steel or alloy and formed of the rim 111 and a wheel disk (not shown). The rim 111 is connected with the bead 104 of the tire, and the wheel disk is connected with a vehicle (not shown). The feature of the safe tire system is in a supporting ring 113 slid onto the well of the rim 111 of the wheel and fixing the supporting ring 113 with the help of a positioning stop 112 of the rim and the bead 104 of the tire. The supporting ring 113, a toroidal elastomer, could be formed as a whole or a combination structure of a plurality of elements.

When the tire suffers from a puncture and leads to a loss of pressure, the sidewall 113 cannot provide a sufficient elasticity to support the tread 101 and the shoulder 102. At this point of time, the supporting ring 113 will take charge in the support of the tread 101 and the vehicle will still be under control and able to travel a safe distance.

As in the above description, the supporting ring 113 can provide backup support when the tire has an unexpected pressure loss. But the safe tire system can not be applied to a general rim because it needs other special elements such as the positioning stop 112 and an appropriate seat (not shown) to house the supporting ring 113 in the well of the rim 111, which is immovable. For this

reason, the consumer must spend more money to buy the safe tire system with a supporting ring 113 and a peculiar wheel that's necessary.

In the above conventional safe tire system, the supporting ring 113 has to provide a sufficient elasticity to support the tire on an exceptional pressure-losing situation for a safe distance. So the supporting ring 113 is usually made up of a hard rubber and must have an enough thickness to maintain the comfort for driving. The heavy weight of the supporting ring 113 will increase the loading of the wheel in an unexceptional situation. In addition, when the safe tire system has to be replaced or repaired and the tire has to be removed from the rim 111, the supporting ring 113 will be blocked. A special mounting and removing machine can be used to extract the supporting device 113 and then reinsert it back to the well of the rim 111, but unfortunately, not every repair shop will be equipped with the special mounting machine within the "safe distance".

Next, a cross-sectional view of another conventional safe tire is shown in FIG.2. The safe tire comprises a general tire and a general wheel. The tire is a symmetrical structure and can be divided into a tread 201, a shoulder 202, a sidewall 203, and a bead 204. The wheel is designed as a single unit of steel or alloy and formed of a rim 211 and a wheel disk (not shown). The rim 211 is connected with the bead 204 of the tire, and the wheel disk is connected with a vehicle (not shown).

The feature of the safe tire is installed in an m-shaped steel rim 213 slid onto the rim 211 of the wheel and fixed in the m-shaped steel rim 213 with the help of the bead 204 of the tire. When the tire suffers from a puncture, which leads to a loss of pressure, the sidewall 213 cannot provide sufficient elasticity to support

the tread 201 and the shoulder 202. At this point in time, the m-shape steel rim 213 will take charge to support the tread 201 and to prevent the bead 204 from separating from the rim 213. So thus enabling the vehicle to travel a safe distance.

As in the above description, the m-shaped steel rim 213 enables the vehicle to travel even in the case of a puncture or insufficient inflation pressure, and the m-shaped steel rim 213 could be utilized in a general tire and a general wheel. But arranging the m-shaped steel rim 213 onto the well of the rim 211 and being jammed by the bead 204 of the tire is a difficult technique. Hence, if the driver has no luck in finding a repair shop with a special mounting machine with a trained technician within the "safe distance", the tire, the wheel and the m-shaped steel rim 213 must be completely changed.

## **SUMMARY OF THE INVENTION**

The present invention has been made in view of the above problems of the conventional safe tire system. An object of the invention is arranging a supporting apparatus on a general tire under the principle of not influencing the normal tire exchange process. The general tire with the supporting apparatus will become a safe tire and keep a vehicle under control and rolling to a safe distance in the case of a puncture or of insufficient inflation pressure.

Another object of the present invention is arranging a supporting apparatus on a general tire to provide a backup support for a vehicle without the matching of a peculiar wheel, the original wheel of the vehicle is sufficient to assist the supporting apparatus in keeping the vehicle under control and rolling to a safe

distance in the case of a puncture or of insufficient inflation pressure.

The other object of the present invention is providing a method for forming a safe tire by arranging a supporting device on a rubber bead of the safe tire. The rubber bead is used for fixing the supporting device on the safe tire and helping to provide a auxiliary backup support.

As mentioned in the above objects of the present invention, a supporting apparatus is installed on a safe tire, providing a backup support when the safe tire has an unexpected loss of pressure and hasn't the ability to support a vehicle. By this supporting apparatus of the present invention, the vehicle could continue to be driven a safe distance.

Additional objects and advantages of this invention will be apparent from the following detailed description of a preferred embodiment thereof that proceeds with reference to the accompanying drawings.

### **BIEIF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is a cross-sectional view of a conventional safe tire system.

FIG. 2 is a cross-sectional view of a conventional safe tire.

FIG. 3A is a front view of a safe tire.

FIG. 3B is a cross-sectional view of the safe tire.

FIG. 3C is another cross-sectional view of the safe tire.

FIG. 4A is a front view of a single supporting element.

FIG. 4B is a front view of the connection of two adjacent supporting elements.

## **DESCRIPTION OF THE PREFERRED EMBODIMENT**

FIG. 3A is a front view of a preferred embodiment of a safe tire 30 according to the present invention. FIG. 3B is a cross-sectional view of the safe tire 30, along with the hatches 3B-3B' of FIG. 3A. FIG. 3C is another cross-sectional view of the safe tire 30, along with the hatches 3C-3C' of FIG. 3A.

Referring to FIG. 3B and FIG. 3C, they are showing two different cross-sectional views of the safe tire 30. First, the safe tire 30 is a symmetrical structure and can be divided into a tread 301, a shoulder 302, a sidewall 303, and a bead 304. The tread 301, running the circumference around the safe tire 30, is the section that makes contact with the road's surface. The shoulder 302 refers to the section starting from the tread 301 edge to the upper part of sidewall 303. The sidewall 303 refers to the side section of the safe tire 30, providing driving comfort through bending and stretching. The bead 304, the bottom part of the safe tire 30, is arranged to hook the safe tire 30 onto a rim 311 of a wheel with a wire bead 305 (composed of steel wire and core rubber). The wheel is designed as a single unit in steel or alloy and formed of the rim 311 and a wheel disk (not shown). The rim 311 is connected with the bead 304 of the safe tire 30, and the wheel disk is connected with a vehicle (not shown).

According to the preferred embodiment of the present invention, a rubber bead 312 is formed in the safe tire 30 with a triangular cross-section. One surface of the rubber bead 312 is pasted with the inner wall of the bead 304, the other two surfaces are intersected by an acute angle to form a circular salient. And a plurality of supporting elements are linked to be a supporting device 313 and chained by the hooked structure of the rubber bead 312. The rubber bead

312 is not only arrange for fixing the supporting device 313 on the safe tire 30, and further, it also provides a auxiliary backup support for the safe tire 30.

In this preferred embodiment of the present invention, the structure of the rubber bead 312 is a circular salient, but other structures which could fix the supporting device 313 on the safe tire 30 such as gear-shaped salient or a plurality of separated salient are also arranged to form the rubber bead 312 of the present invention. And the material of the rubber bead 312 of this preferred embodiment is a hard rubber, but other materials which could make a good connection with the bead 304 and provide a high elasticity could also be the material of the rubber bead 312 of the present invention. In addition, another rubber bead (not shown) could be formed in the safe tire 30 and pasted with the inner wall of the bead 304, matching with the rubber bead 312 and enhancing the combination with the supporting device 313 according the present invention.

The supporting device 313 is composed of a plurality of supporting elements. Referring to FIG. 3B, the cross-sectional structure of each supporting element could be divided into a supporting section 314, a connection section 315 and an indentation section 316. The supporting section 314 is contacted with the inner wall of the tread 301 when the inflation pressure of the safe tire 30 is lost. In this preferred embodiment, the supporting section 314 is a flat surface, but a rough structure such as grooved hollow or a plurality of bulges could also be formed on the surface of the supporting section 314 to increase the friction between the surface of the supporting section 314 and the inner wall of the tread 301 in the safe tire 30. The indentation section 316 of the supporting device 313 is mounted on the salient structure of the rubber bead 312, meanwhile, referring to FIG. 3C, a cross-section view of the safe tire 30 is shown in the connection situation

between the indentation section 316 of the supporting device 313 and the rubber bead 312. In the connection section 315, each supporting element is provided with a hollow structure and is run through by a rivet 317 (fixing device). Referring to FIG. 3C, a plurality of supporting elements are linked by a chain and surrounded with the rubber bead 312, and each supporting element is connected by the rivet 317 and a side plate 318 (connection device).

In this preferred embodiment of the present invention, the side plate 318 is used to connect with two adjacent rivets 317 of the connection section 315 of the adjacent supporting elements. But other connecting devices and methods have the ability to fasten the adjacent supporting elements will also be arranged in the present invention. And referring to FIG 3B, the structure of the connection section 315 of the supporting element is arranged with a hollow structure, and in this preferred embodiment, the material of all supporting elements is an aluminum alloy. The above designs are aimed to lower the weight of the supporting device 313 and decrease the loading of the safe tire 30. And other materials such as rubber and transition metal are also could be utilized to make the supporting elements according to the present invention.

Referring to FIG. 4A, a front view of a single supporting element. The structure of each supporting element of the supporting device 313 could be divided into a supporting section 314, a connection section 315 and an indentation section 316. The connection section 315 is provided with two hollow structures of this preferred embodiment of the present invention. Referring to FIG 4B, a front view of the connection of two adjacent supporting elements. The two hollow structures of the connection section 315 are run through by two rivets 317, and a side plate 318 is used to connect with two adjacent rivets 317 of



the connection section 315 of the adjacent supporting elements. Besides, in order to enhance the combination of the adjacent supporting elements of this preferred embodiment, each supporting element is provided with a malposition structure. The plurality of supporting elements will be linked like a caterpillar to form the supporting device 313.

In this preferred embodiment of the present invention, each supporting element is provided with two hollow structures on the connection section 315, but the number of hollow structures of the connection section 315 will not be limited of this preferred embodiment. Providing a single hollow and positing it on the malposition structure will also be used to connect the adjacent supporting elements 315. The number of the plurality of supporting elements is depended on the size and the driving comfort of the safe tire 30.

According to the above description of a preferred embodiment of the present invention, a supporting device 313 is installed on a rubber bead 312 of a safe tire 30, providing a backup support when the safe tire 30 has an unexpected loss of pressure and hasn't enough ability to support a vehicle. By this supporting device 313 of the present invention, the vehicle could continue being driven a safe distance.

Skilled workers will further recognize that many changes may be made to the details of the above-described embodiment of this invention without departing from the underlying principles thereof. Accordingly, it will be appreciated that this invention is also applicable to color synchronization applications other than those found in multimedia projectors. The scope of the present invention should, therefore, be determined only by the following claims.